The account of the recent excavations of Tycho's observatory thus forms a valuable supplement to the description published by Tycho himself. The idea of seeking shelter from the wind, by erecting his large instruments a couple of feet below the level of the ground, was a good one, and on the small island the force of the wind was doubtless not a negligeable quantity, particularly as the observatory was situated almost at the highest point of the island, about 160 feet above the sea, which is visible in all directions except in the south-east. Picard remarked that except where some hills in Scania rise to an altitude of 11′, he had often seen the stars down to the very horizon, which he considered very surprising, as this was never possible at the Paris Observatory, although the latter was about 120 feet higher than the level of Tycho's observatory. But the example thus set by Tycho was not followed; for more than a hundred years the object seemed generally to be to get as near to the stars as possible by placing observatories on the top of towers and high buildings—and in the midst of crowded cities. The nineteenth century has reverted to Tycho Brahe's ideas by building observatories at some distance from cities and with the instruments at very moderate heights above the ground. Another idea of Tycho's, which was not adopted for several centuries, was to have a large staff of assistants, among whom the work of the observatory was divided. He had cherished the hope for many years that the institution founded by him would be made a permanent one and not come to an end with his own life. Unfortunately he did not succeed in getting this settled in the lifetime of his benefactor, King Frederic II., and when he finally found that not only was it hopeless to expect a permanent endowment, but that even some of the valuable grants he had enjoyed for years were taken from him, he resolved to try if some other monarch would carry out his favourite idea and found a public observatory on a large scale. But Tycho had been very many years in his grave before this was done anywhere.

J. L. E. DREYER.

TECHNICAL SCHOOLS FOR RURAL DISTRICTS.

ENCOURAGED by the success which has attended the work of her sister, the Countess of Warwick, at Bigods, near Dunmow, in Essex, the Duchess of Sutherland has boldly entered upon a scheme for providing a technical school in a still more remote rural district, viz. near Golspie, on their Dunrobin estate in Sutherlandshire. No provision for secondary and technical education in the Scotch Highlands at present exists, and the proposed school must meet a long-felt want. The draft scheme which has been drawn up by the Duchess with the cooperation of Prof. Meldola provides for the education of fifty pupils in the principles of those sciences which bear in any way upon the local industries, including agriculture. The pupils will be taken from the elementary schools and admitted only when fully qualified to take advantage of the secondary training offered by the Sutherland school. In view of the excellent character of the elementary teaching in the Scotch schools, there should be no difficulty in finding a constant supply of promising pupils, the more especially as the new school is intended for board and residence and caters for the four counties of Sutherland, Ross, Cromarty and Caithness. Like Bigods, the Sutherland technical school is to be mixed and the curriculum adapted to the requirements of boys and girls. As stated in the scheme :—

"It is impossible that education in the Highlands should continue on the present lines. There is practically no technical training whatever. The old form of 'classical' education is still persisted in, and often a whole school suffers for the sake of three or four clever pupils who win the bursaries which send them to the University, from whence they issue as clerks, doctors or ministers as the case may be. The others are left to drift into idleness or to go away south to add to the population of our already over-crowded cities. The overcrowding of the fisher class is undisputed, and the dearth of skilled masons, carpenters and artisans, or competent hand-workers in the north, apart from the homespun tweed industry, is remarkable. There have been many peripatetic technical classes carried on under the County Councils and School Boards in the north, but this is the first technical school of the kind that has been started in the Highlands. It should be the pioneer of much educational reform, and it is started with a great belief in its ultimate possibilities."

The scheme has been considered by many educationists and has been approved of by Lord Balfour of Burleigh, Mr. Struthers, of the Scotch Board of Education, Sir Swire Smith, Mr. James Baker, Prof. Magnus Maclean and others. Practical appreciation of her Grace's efforts in the cause of education has also been shown by the substantial support which the scheme has already received. The Duke of Sutherland has given the site for the building and land for the agricultural work close to Golspie, besides 5000*l.* towards the building and equipment fund. Mr. Andrew Carnegie contributes 5000*l.* to the same fund and Mrs. Carnegie two bursaries of 30*l.* each annually. The Duke and Duchess of Sutherland, the Dukes of Westminster and Portland, and Mr. James Coates, of Paisley, also contribute annual bursaries. The work thus commences under very good auspices and is worthy of the most cordial support by all who are interested in the welfare of Scotland. At the present time, when "official" educators are, as was said recently, whistling for the wind of popular opinion, the country may well be proud of the splendid examples set by the Countess of Warwick in Essex and by her sister in the Highlands of Scotland. As pioneers in the introduction of scientific education into rural districts the names of these ladies will be written large in the annals of our educational development.

A PERIODICAL FOR STATISTICAL BIOLOGISTS.[1]

THE receipt of the first part of the new periodical, *Biometrika*, calls for more than mere formal acknowledgment. The methods of investigating biological problems statistically may be looked upon as having their origin in this country, and the names of the editorial staff are those of the pioneers in this modern departure—Francis Galton, and Profs. W. F. R. Weldon and Karl Pearson, associated with Prof. C. B. Davenport, of the University of Chicago. The part received is prefaced by an editorial article setting forth the scope and defining the spirit of the publication and an article on biometry from the pen of Mr. Galton. An admirable figure of the Darwin statue in the University Museum at Oxford, reproduced from a photograph by Mrs. E. B. Poulton, forms an appropriate frontispiece, the motto "*Ignoramus, in hoc signo laboremus*," being printed below the illustration. The papers contributed to this first part are seven in number, including those already mentioned. Prof. Dr. F. Ludwig writes (in German) on problems and materials for variation statistics; Mr. A. O. Powys con-

[1] *Biometrika*. A Journal for the Statistical Study of Biological Problems. (Cambridge: University Press. New York: The Macmillan Company.) Price 10*s*.

tributes data for the problem of evolution in man, anthropometric data from Australia; Miss Beeton and Prof. Pearson furnish a paper on the inheritance of the duration of life and the intensity of natural selection in man; Mr. E. T. Browne writes on variation in *Aurelia aurita*, and Prof. Weldon on a first study of natural selection in *Clausilia laminata*.

This first list of contributions augurs well for the future of an undertaking which deserves support from all workers in science who are interested in the theory of organic evolution in its broadest applications. The points of contact between mathematicians and biologists have hitherto been but few, and the time is yet remote when we may look for the advent of a skilled mathematician who shall also be an expert biologist, or *vice versâ*. But although the modern biologist may be unable to follow the mathematical processes of the new method, he will assuredly be impressed with the importance of the results, and such a work as that which has now been launched will serve as a common meeting ground for both classes of workers. The recognised methods of studying living organisms from the points of view of systemy and taxonomy, embryology, histology and anatomy, bionomics and distribution have all contributed to the sum total of that great division of natural knowledge which is known by the comprehensive title of biology. Side by side with these we must now place the newer statistical methods inaugurated with such marked success by Galton. This latest claimant to recognition as a legitimate weapon of scientific attack may be looked at with suspicion by those who are accustomed only to the older methods. We may remind our readers, however, that the value of measurement and statistical treatment was fully realised by Darwin, as made clear in one of the editorial articles in the present part of *Biometrika*. We may point out also that Wallace in his "Darwinism" (1889) fully recognised the value of such methods, and made considerable use of the measurements of lizards by Milne-Edwards and of birds by Mr. J. A. Allen for his discussion of the question of individual variability as furnishing the material for the operation of natural selection. Such data were imperfect compared with the modern requirements of statistical methods, but so far as they went they have been of service to the cause of Darwinian evolution, and this fact, again, tells strongly in justification of the appearance of a new periodical devoted entirely to this phase of biology.

There is no real antagonism—as some men of science have supposed to exist—between the older methods and the latest statistical methods. They are, or should be, on the contrary, mutually helpful. If by the measurement of large numbers of individuals and the mathematical treatment of such data the trend of evolution in any species can be detected, here at once is a suggestion for the observing naturalist to work upon—to endeavour to find out the nature and cause of the survival in a certain direction; in other words, to hunt down the selecting agent. Where ordinary observation has in so many cases failed, the newer methods appear to open out endless possibilities of attacking such problems. The student of bionomics will, as statistical data and their deductions accumulate, have definite information given as to what is going on in particular species, and it will be for him to approach the study of such species armed with specific questions awaiting answer in the field or laboratory. We venture to think that, far from any antagonism existing between the older and newer methods, the introduction of statistics in the Galtonian sense cannot but give a great impetus to observational work. It may be added that the periodical is really cosmopolitan, and the editors invite contributions in German, French or Italian, as well as in English. We cordially wish the new journal the success which it merits

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held as usual on St. Andrew's Day, November 30, when the annual report of the Council to the Fellows was presented. Among the subjects mentioned in this report is the proposal to establish a British Academy, which was discussed at a special meeting of the Society held in May last.

Reference is made by the Council to the subject of the tenure of office of the secretaries, which was recently raised again. A memorial "praying the President and Council to take into immediate consideration the advisability of limiting the tenure of office of any future treasurer or secretary," and also a memorial expressing the decided convictions of the memorialists that the change advocated by the preceding memorial would not be in the interests of the Society, were taken into consideration at the meeting of the Council on November 7. It was proposed, as a resolution, "That in the opinion of this Council it is desirable that the secretaries should not be so re-elected as to hold office for a period exceeding ten consecutive years, this resolution not to apply to the present holders of office," and, after considerable discussion and the consideration of various amendments, the resolution was carried.

As already announced, in consequence of his appointment as Principal of the University of London, Prof. Rücker has resigned his office as secretary, and is now succeeded by the distinguished mathematician and physicist, Dr. Joseph Larmor.

The address of the president referred to the scientific work of the Fellows and Foreign Members deceased since the former annual meeting, and a few investigations commenced or carried on in the course of the year. The work of this year's medallists was described as follows:—

COPLEY MEDAL.

Prof. J. Willard Gibbs, Foreign Member, R.S.

The Copley Medal is awarded to Prof. J. Willard Gibbs, a Foreign Member of this Society, for his contributions to mathematical physics.

Although Horstmann had demonstrated, between 1869 and 1873, the applicability of the mechanical theory of heat to the elucidation of the phenomena attending dissociation, J. Willard Gibbs was the first to apply the second law of thermodynamics to the exhaustive discussion of the relations between chemical, electrical and thermal energy and capacity for external work. His great contribution to this subject appeared in the *Transactions* of the Connecticut Academy in two parts, the first in 1875 and the second in 1878. In this paper, which opens with a discussion of the criteria of equilibrium and of stability as applying to a material system, the conditions of equilibrium prevailing in both homogeneous and heterogeneous systems of gaseous, liquid and solid materials are considered in a highly generalised form; and it is shown by Gibbs that Deville and Troost's experimental values of the density of nitrogen peroxide at different temperatures, and Playfair and Wanklyn's results obtained with mixtures of nitrogen peroxide and nitrogen, can be interpreted quantitatively with the aid of his fundamental gas equation.

The most important result of Gibbs's work, from a chemical standpoint, is the so-called "phase rule," the law which governs the general case of complete heterogeneous equilibrium. This law, which was developed theoretically, states that a system in complete heterogeneous equilibrium must be composed of at least n different molecular components if it consists of $n+1$ different phases.

The application of the phase rule has been repeatedly verified experimentally under a great variety of aspects. During the last few years the recognition of the law has led, amongst other important results, to a complete systematisation of our knowledge concerning dissolution of solid substances, the distribution of a solute between two immiscible solvents, and to the formation of double salts and of racemic, pseudo-racemic, non-racemic